Should We be More Worried When Our Fathers or Our Mothers Get Admitted to Hospital? Sex Differences in 1-Year Survival After the First Admission to Hospital at Age 50+

Höhn , Andreas ; Larsen, Lisbeth Aagaard; Rau, Roland; Lindahl-Jacobsen, Rune; Christensen, Kaare; Oksuzyan, Anna

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Should we be more worried when our fathers or our mothers get admitted to hospital? Sex differences in 1-year survival after the first admission to hospital at age 50+.

Andreas Höhn *, Lisbeth Aagaard Larsen, Daniel Christoph Schneider, Rune Lindahl-Jacobsen, Roland Rau, Kaare Christensen, and Anna Oksuzyan

Background

Death statistics consistently report that women have lower mortality at all ages and an advantage in survival with respect to most causes of death, including acute life-threatening events.[1–4] While the relative sex differences in mortality peak around age 25 and tend to become smaller with age, the absolute sex differences grow almost exponentially between age 40 and 90 as the overall level of mortality increases.[5,6]

Nevertheless, it remained unclear whether the magnitude of the sex differences in survival changes generally after the onset of a health deterioration. We expect the sex differences in survival to be larger after the onset of a health deterioration, measured as a hospital admission. To examine this, we compare the absolute sex differences in short-term survival after hospital admission with the differences we would have observed in the corresponding general population and the population never-hospitalized.[7]

Methods and Materials

Data

This study uses a 5% random sample of the Danish population. Using the unique Danish personal identification number (CPR-Number), we linked records from the National Patient Register (NPR) with data of the Central Population Registry (CPR). The NPR is a population-based register with nationwide coverage which contains information on all admissions to public hospitals since 1977, and private hospitals since 2003.[8,9] Data on hospital admissions were available for the period 1977–2011 while the vital status of persons was traceable up to 2013.

*Correspondence to:
Andreas Höhn
Email: hoehn@demogr.mpg.de

Study Population

We identified all individuals who were born between January 1 1927 and December 31 1961, who survived up to age 50 in Denmark, and were considered as active in the registers (n=119,510). Out of those, 57.6% (n=68,822) of the sample had been admitted to the hospital at least once between January 1 1977, and December 31 2011. Hospitalization was defined as the first time an individual was admitted to the hospital after reaching age 50 as an inpatient, for any reason, and at least for one night. Subsequent admissions and admissions that occurred among these individuals before age 50 or after age 69 were not taken into account.

Two matched populations were selected randomly from the initial pool of persons from which we identified the hospitalized population: one group to represent the corresponding general population, and the other group to represent the never-hospitalized population. The matched individuals, forming the two reference populations, had to be the same age (+/- 30 days), the same sex, and alive on the day the corresponding case was hospitalized. Whereas the individuals representing the general population were selected irrespective of hospitalization status, the individuals representing the never-hospitalized population had not been hospitalized between age 50 and 69. The matching was carried out 100 times to increase the robustness of the matching results, and to bypass the need to choose a single matching scenario. An overview of the three populations is given in Table 1. While the data for the hospitalized population represent the exact number of observed cases, the numbers for the general and the never-hospitalized population refer to the mean of 100 matched samples.

Table 1: Number of individuals, number of deaths, and the risk of dying within 1 year of follow-up by sex and age in the hospitalized, general, and never-hospitalized population.

Age at first	**Men**				**Women**			
Hospitalization /	**Individuals**		**Deaths**		**Individuals**		**Deaths**	
Age of Matches	**No.**	**in %**	**No.**	**Risk**	**No.**	**in %**	**No.**	**Risk**
				Hospitalized Population				
50–54	17,084	49.02	828	0.0485	18,041	53.10	560	0.0310
55–59	8,947	25.67	545	0.0609	8,223	24.20	331	0.0403
60–64	5,678	16.29	476	0.0838	4,838	14.24	247	0.0511
65–69	3,140	9.01	313	0.0997	2,871	8.45	216	0.0752
total	**34,849**	**100.00**	**2,162**	**0.0620**	**33,973**	**100.00**	**1,354**	**0.0399**
				General Population				
50–54	17,088	49.03	113	0.0066	18,029	53.07	83	0.0046
55–59	8,946	25.67	101	0.0113	8,239	24.25	50	0.0060
60–64	5,674	16.28	88	0.0155	4,835	14.23	50	0.0104
65–69	3,142	9.02	78	0.0247	2,870	8.45	44	0.0154
total	**34,849**	**100.00**	**379**	**0.0109**	**33,973**	**100.00**	**227**	**0.0067**
				Population Never Hospitalized at Age 50–69				
50–54	17,086	49.03	85	0.0050	18,028	53.07	30	0.0016
55–59	8,947	25.67	45	0.0050	8,241	24.26	14	0.0017
60–64	5,674	16.28	33	0.0058	4,833	14.23	11	0.0023
65–69	3,142	9.02	21	0.0067	2,870	8.45	6	0.0022
total	**34,849**	**100.00**	**183**	**0.0053**	**33,973**	**100.00**	**61**	**0.0018**

Statistical Analysis

The survival time of hospitalized individuals starts with the day of the first hospital admission. Analogously, the process time of matches starts on the day the corresponding case was hospitalized. As a first step, we used a generalized additive model (GAM), stratified by sex and population, to model the age-specific risk of dying and to smooth over age. In a next step we compared the male excess mortality across the three populations.

Preliminary Results

We found that the risk of dying was highest in the hospitalized population (0.0511; 95% CI: 0.0527 – 0.0495), was lower in the corresponding general population (0.0088; 95% CI: 0.0095 – 0.0081) and lowest among never hospitalized individuals (0.0035; 95% CI: 0.0039 – 0.0031). In all three populations, men had higher mortality than women. As shown in figure 1, at all ages, the absolute sex differences were largest in the hospitalized population. The higher sex differences in mortality after hospitalization resulted on average in additional 18.4 male deaths per 1,000 persons when compared with the general population, and in additional 20.3 male deaths per 1,000 persons in comparison with the population never hospitalized at age 50-69.

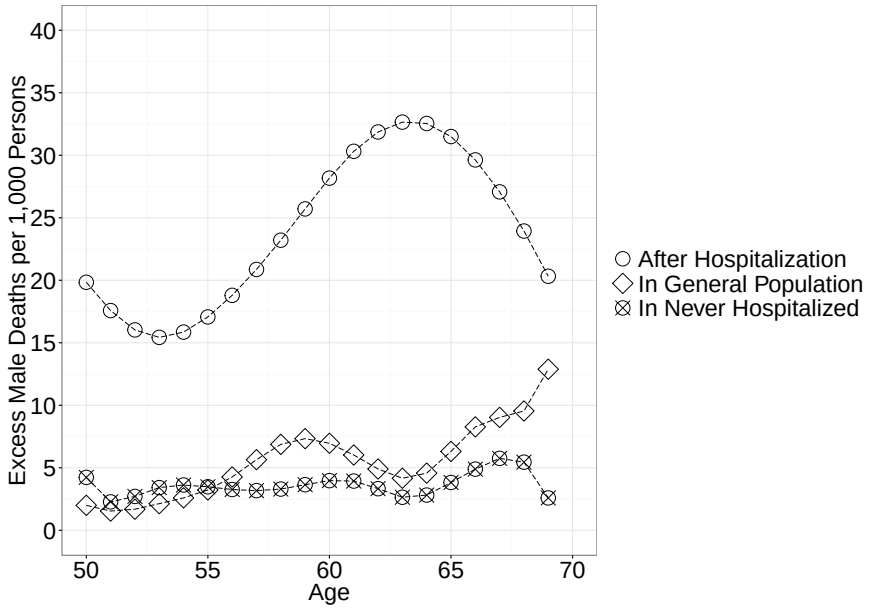

Figure 1: Absolute sex differences in the risk of dying within 1 year of follow-up.

Outlook and Conclusion

As our study showed that the male excess mortality was highest in the hospitalized population in comparison to both reference populations, our findings suggest that absolute sex differences in survival become more pronounced as health of the population deteriorates. Moreover, the increased mortality among the hospitalized population in comparison with the two healthier references underlines that an admission to hospital may serve as a health indicator.

To gain additional insights into the mechanisms behind the observation of larger sex differences in survival after hospital admission, future research should address especially the gender differences in treatment-seeking behavior.

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